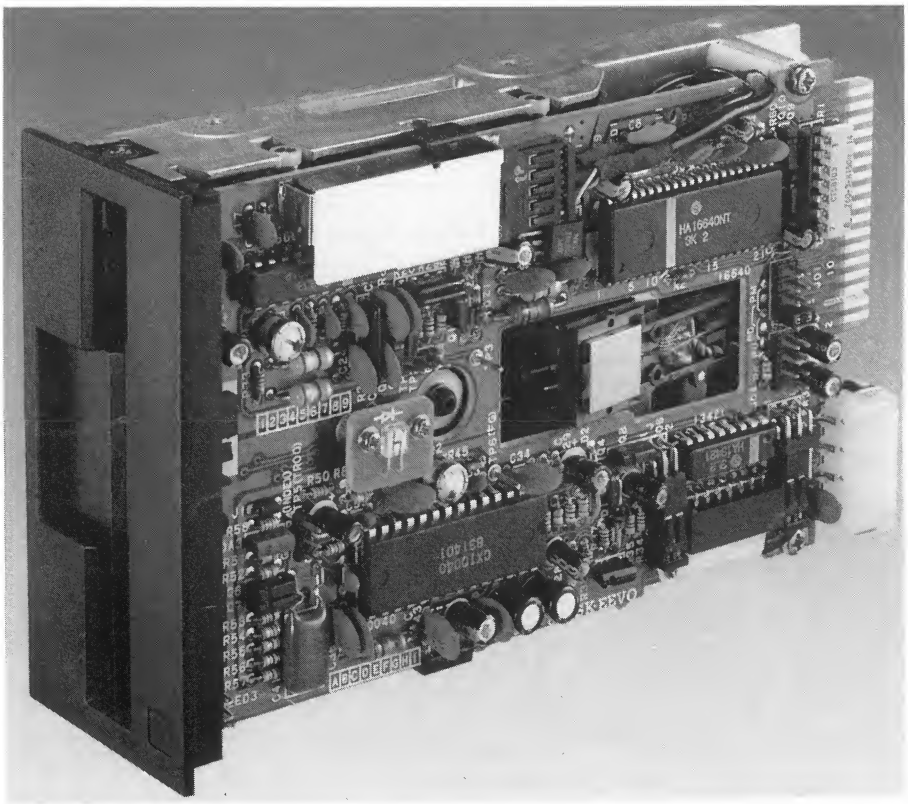
HITACHI COMPACT FLOPPY DISK DRIVE
MODEL HFD305S

3″-SINGLE-SIDED, DOUBLE-DENSITY TYPE

INSTRUCTION MANUAL



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1. SPECIFICATIONS

(1) Performance

Table 1 Performance

Item \ Type			Single density (FM)	Double density (MFM)
Capacity (one side only)*1	Unformatted		125 k bytes	250 k bytes
	Formatted	128/ 256B × 16 sectors	81.9k bytes	163.8k bytes
		256/ 512B × 9 sectors	92.2k bytes	184.4k bytes
		512/1024B × 5 sectors	102.4k bytes	204.8k bytes
Transfer rate			125k bits/sec	250k bits/sec
Recording density (innermost circumference)			4473 BPI	8946 BPI
Recording system			FM	MFM
Track density			100 TPI	
Cylinders			40	
Total No. of tracks			40/single side, 80/double side	
Media rotational speed			300 rpm	
Average latency time			100 ms	
Motor start time *2			0.7 s max	
Access time	Average access time		55 ms	
	Track to track *3		3 ms	
	Settling time		15 ms	
Data sector			Soft sector 5, 9, or 16	
Record media			3-in. Compact Floppy Disk	

NOTES: *1 When a floppy disk is inserted with its A-side reversed, its B-side can be used. When both the A-side and B-side are used, the capacity is doubled.

*2 The lapse of time from output of the MOTOR ON signal until the motor has reached the specified rotational speed.

*3 Settling time is not included.

(2) Power Specifications

Table 2 Power Specifications

Power	Status / Item	Standby	Operating	During motor start-up
DC 12V	Tolerance	± 5%		
	Ripple noise	100 mV p-p or below		
	Current consumption	0.1A (typ)	0.7A (max)	1A (max)
DC 5V	Tolerance	± 5%		
	Ripple noise	50 mV p-p or below		
	Current consumption	0.5A (typ)	0.8A (max)	
Nominal power consumption		3.7W (typ)	12.4W (max)	——

NOTES: 1. Current consumption and power consumption during standby are reference values.

2. "Standby", "Operating", and "During motor startup" respectively correspond to the following status:

	Drive motor	Record media	SEEK operation
Standby	OFF	Dismounted or mounted	OFF
Operating	ON	Mounted	ON
During motor start-up (within one sec. from MOTOR ON)	ON	Mounted	OFF

NOTES: 3. Both supply voltage tolerance and ripple noise refer to the specified value for the drive-side receiving end.

4. When the power is turned ON, switching to the standby status is not effected until the READY signal is output.

(3) Environment Specifications

Table 3 Environment Specifications

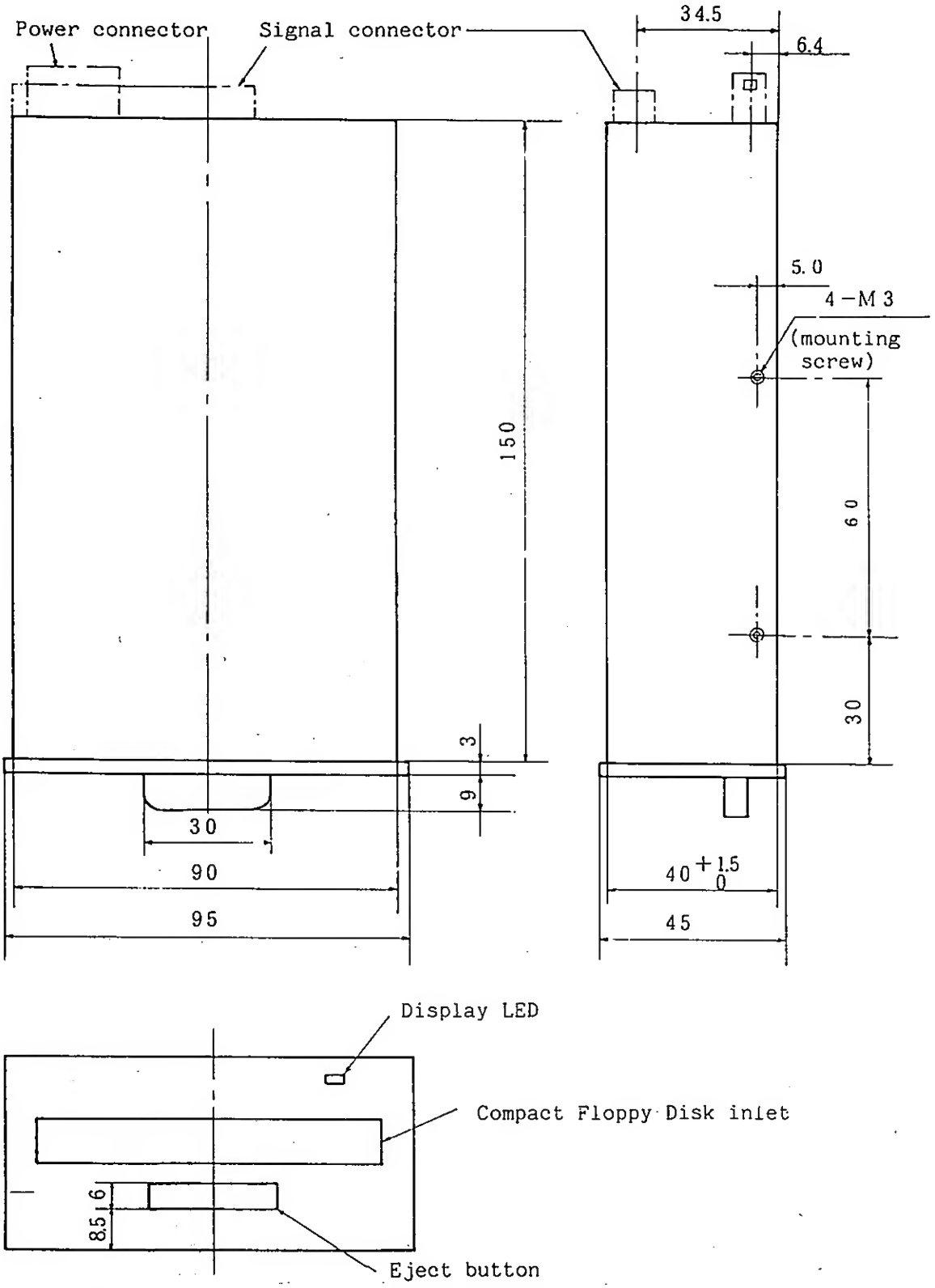
Item	Operating	Nonoperating
Ambient temperature	10 ∼ 40°C	-20 ∼ 50°C
Relative humidity	20 ∼ 80% RH	Noncondensing
Max. wet-bulb temperature	29°C or below (noncondensing)	

(4) Mounting Specifications

Table 4 Mounting Specifications

Item		Specifications	
Outer dimensions (mm)*1		90 (W) × 40 (H) × 150 (D)	
Weight (kg)		0.7	
Vibration	Operating	1G max. (5 ∼ 100 Hz, in X, Y, and Z direction)	
	Nonoperating	2G max. (5 ∼ 100 Hz, in X, Y, and Z direction)	
Resistance to shock during transport		Conforming to all requirements of specifications even if dropped from 50 cm height in packaged status.	
Mounting direction		Sideways	 or
		Horizontal	 With drive motor set at lower side

NOTE: 1. Outer dimensions refer to that portion at the rear of front panel. For details, refer to Fig.1 "Diagram of Outer Dimensions and Mounting Dimensions" on the following page.



NOTE: Screwing length of the mounting screw must be below thickness of fitting plate plus 5mm.

Fig. 1 Diagram of outer dimensions and mounting dimensions

(5) Reliability Specifications

Table 5 Reliability Specifications

Item		Specifications
MTBF		8,000 POH (reference value) *1
MTTR		0.5 Hr
Unit life		Five years or 15,000 POH, whichever is shorter (maintenance parts excluded)
Error rates	Soft errors	10^{-9} times/bits
	Hard errors	10^{-12} times/bits
	Seek errors	10^{-6} times/seeks

NOTE: 1. Running time of the drive motor is set at 25% of POH (POWER ON hours) under normal operating conditions. And pad exchange time interval is 2,000 POH.

2. CONFIGURATION

The Compact Floppy Disk Drive (FDD) consists of a mechanical part and a logical part. Fig. 2 is a schematic diagram of its construction.

(1) Load/Unload Mechanism

Media loading is automatically effected by inserting the cartridge of the Compact Floppy Disk. In this case, the shutter of the head opening is automatically opened so that head loading can also be effected.

By pressing the eject button, the record media is automatically ejected.

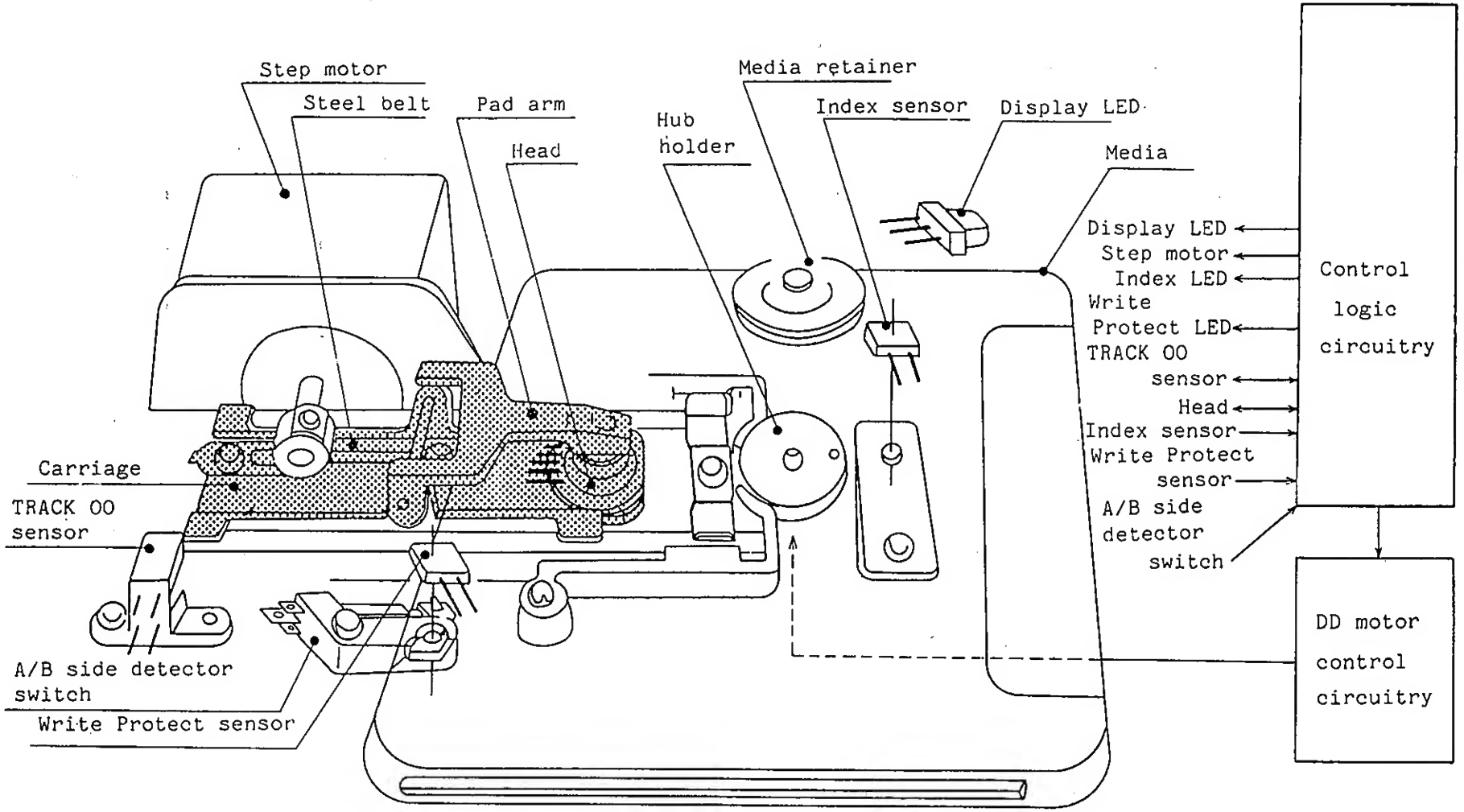


Fig. 2 Construction Schematic Diagram

(2) Drive Mechanism

The drive mechanism consists of a drive motor, drive pin, and hub retainer. The drive pin connected to the drive motor fits into the hub drive groove of a record media for driving the mechanism.

(3) Positioning Mechanism

Carriage positioning is effected by a step motor through using a steel belt.

(4) Index Sensor

Upon sensing an index hole (small hole) in the record media, the LED/Photo Transistor combination produces an index pulse.

(5) Track 00 Sensor

Upon sensing--according to the carriage position--that the magnetic head is positioned at Track 00, this sensor produces a TRACK 00 signal.

(6) Write Protect

The write protect circuitry consists of a pair of LED and a photo transistor, and a logic circuit. Checking is effected by the status of a write inhibit detection hole in the Compact Floppy Disk plastic case; when the hole is not masked, a write inhibit status is established so that data writing is rejected.

(7) Operation Display LED

Mounted on the front panel, this operation display LED is designed to notify the user that the drive is in a specific state of operation. This LED is turned ON through "OR" of the IN USE signal and the DRIVE SELECT signal.

When the B-side on the loaded disk is in the IN USE state, the red LED is lit. When the A-side is in use or no disk is loaded, and the IN USE signal or DRIVE SELECT signal is given, the green LED is lit.

(8) Drive Motor Control

This electronic control circuit enables the brushless, direct drive motor to run at a stabilized, fixed speed against load fluctuations.

Further, a host system power connector and a part of the Logic PCB such as the step motor drive circuit are mounted on this control.

(9) Logic PCB

The control circuit, which consists of a control logic circuit including a Write/Read control circuit, controls the drive in accordance with instructions from a host system.

The Logic PCB contains the following main circuits; a block diagram of the logic circuit is shown in Fig. 3.

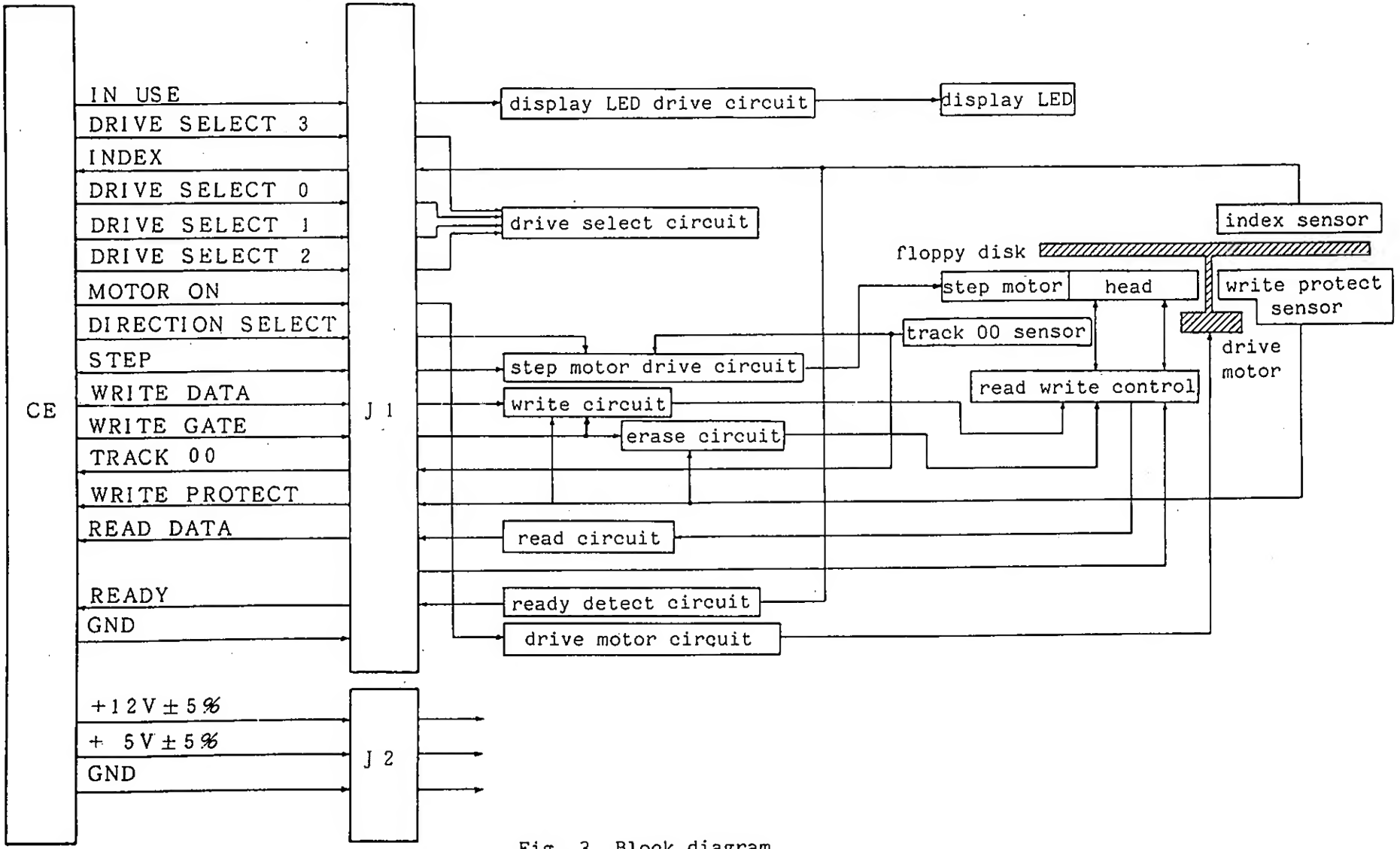


Fig. 3 Block diagram

a) DRIVE SELECT circuit

b) Positioning control circuit

c) INDEX detector circuit

d) WRITE PROTECT detector circuit

e) TRACK 00 detector circuit

f) READY detector circuit

g) Read circuit

h) Write circuit

3. RECORDING MEDIA

(1) Recording Media

The recording media applied to this FDD is made of flexible mylar sheet provided with magnetic material coating and enclosed in a special plastic case as shown in Fig. 4.

Mark

This floppy disk is applied to the floppy disk drive wearing this mark.

(2) Operating Method

(a) This floppy disk permits its use on both sides.

(b) When using the floppy disk on a single-sided type drive, turn the disk over upon completing operation on the A-side and operate it on the B-side.

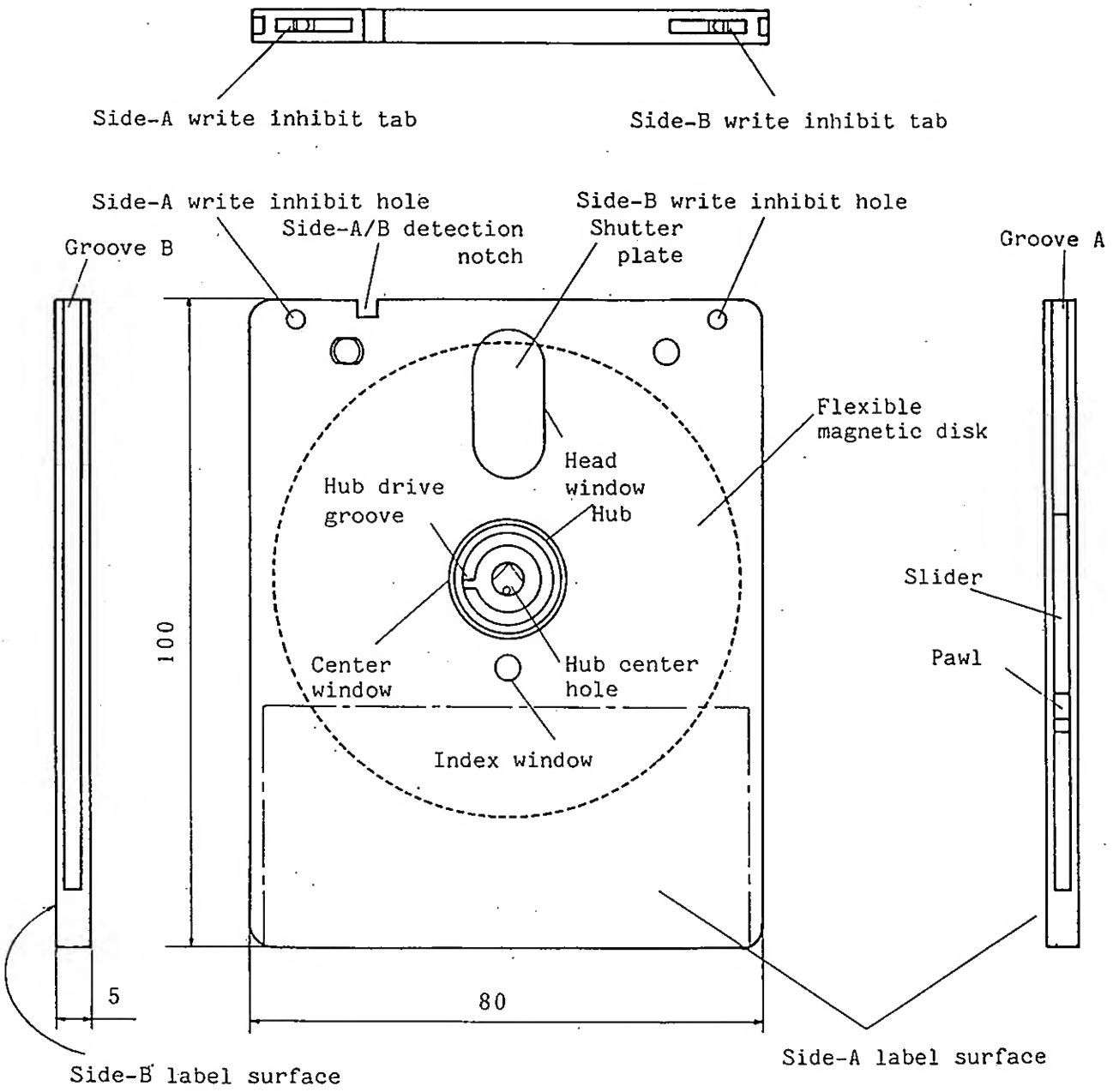


Fig. 4 Recording Media

(c) Data writing is not effective when moving the write inhibit tab and opening the write inhibit hole by a ball-point pen or the like.

(d) Insert the floppy disk straight and precisely into the drive.

(3) Handling Instructions

(a) Do not open the shutter nor finger the magnetic surface.

(b) Do not forcibly depress the shutter plate nor apply an excessive force to the opening/closing spring (slider); trouble may result.

(c) Do not forcibly bend the body. Trouble may result.

(d) Do not use the floppy disk with its hub deformed or dusty; otherwise, errors may occur. Keep the disk constantly clean.

(e) Do not attempt to clean with thinner, alcohol, freon, or similar chemicals.

(f) Do not use a rubber eraser for cleaning.

(g) Avoid eating/drinking and smoking near the floppy disk.

(4) Storing Instruction

(a) Upon completion of operation, be sure to insert the disk in the designated case for storage.

(b) Store the floppy disk in a location free from high temperature, moisture, and direct sunshine.

(c) Do not store the floppy disk in a location exposed to a magnetic source.

(d) Do not store the floppy disk in a dusty site.

(5) Operating Environment

Use the Compact Floppy Disk under the following conditions:

Temperature	:	10 to 50°C
Relative humidity	:	20 to 80%
Wet-bulb temperature	:	29°C or below
Max. rate of temperature variation	:	20°C/h
Ambient magnetic field	:	4000 A/m or below

(Noncondensation on the outer and inner surface of compact floppy disk)

(6) Preservation Environment

The Compact Floppy Disk must be stored under the following conditions:

Temperature	:	4 to 50°C
Relative humidity	:	8 to 80%
Ambient magnetic field	:	4000 A/m or below

Prior to using a Compact Floppy Disk exposed to temperature/humidity not conforming to the operating environment specification over a long period, the disk must be adapted to the operating environment.

4. DATA FORMAT

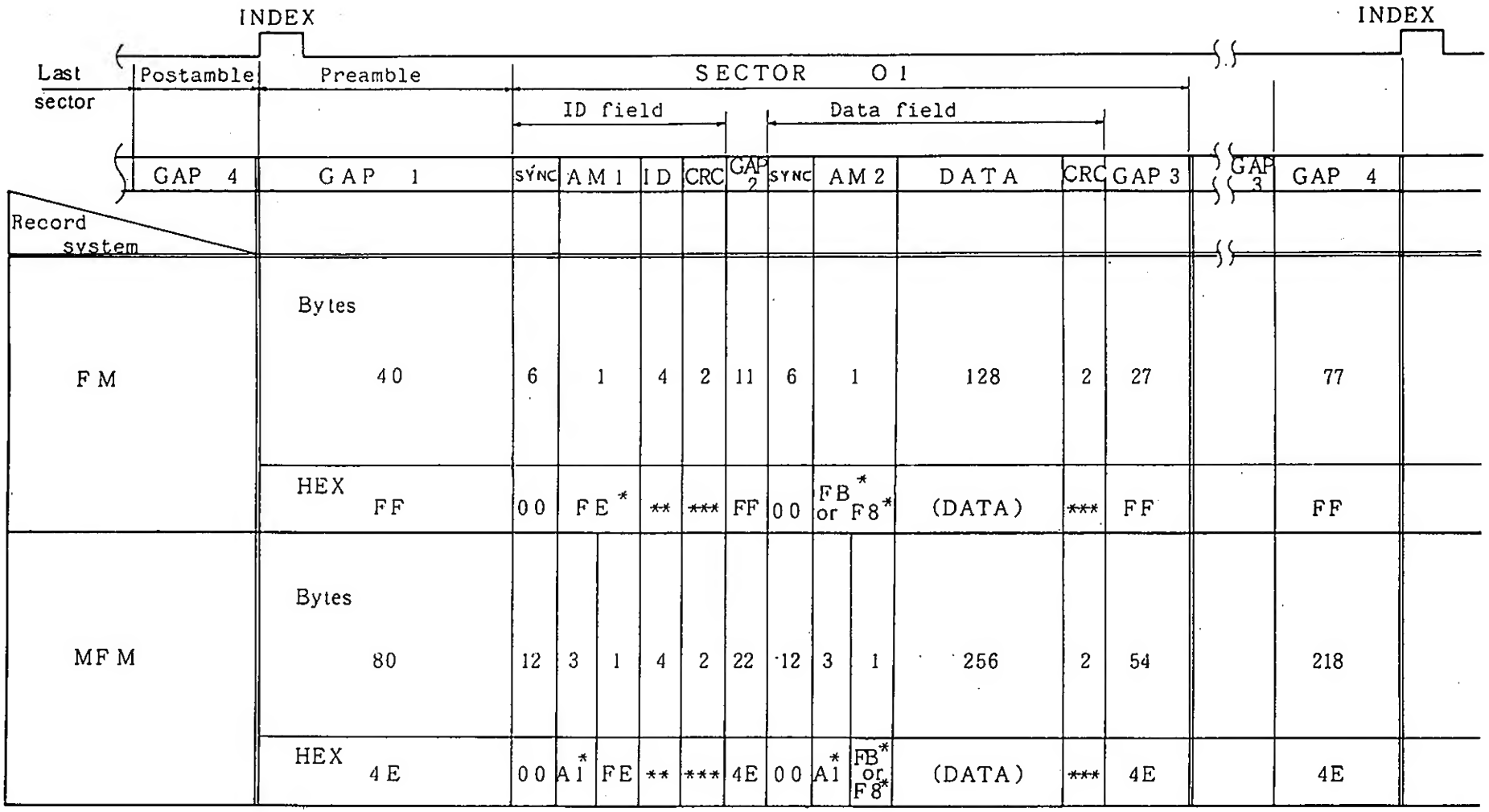
The HFD 305S permits the use of soft-sectors. Data configuration on the disk can be freely designed according to the user's host system function. An example of the data format is illustrated in Fig. 5 on the following page.

The recommended format includes a single-density type with 16 sectors (128 bytes/sector) and a double-density type with 16 sectors (256 bytes/sector).

5. INTERFACE

(1) Connection

Two connectors are used for interface connection. One is 34-pin card edge connector J 01 through which signals are received and delivered. The other is



* Indicates the presence of missing clock.
** Indicates ID field.
*** Indicates CRC check character.

Fig. 5 Example of Data Format (16 sectors)

4-pin MATE-N-LOK connector J 02 through which the HFD 305S is supplied with +12V and +5V DC power.

The signal interface is available in two types: daisy chain and radial chain. In the daisy chain connection, all terminators must be disconnected except the last one which is terminated as clearly shown in Fig. 6. Provided with four signal lines for use of drive select, the drive side permits daisy chain connection to a maximum of four units by changing dip switch setting.

(2) Cable and Connector

The HFD 305S employs two types of cable--a cable for signal (SIG cable) and a power supply cable (DC cable). The SIG cable is connected to connector J 01; the DC cable is connected to J 02-- both on the drive side.

When the HFD 305S is directly mounted on the grounded frame of a host system, usually no ground cable needs to be installed.

Fig. 8 shows the mounting position of each connector; Fig. 9 is the connector pin arrangement; Fig. 10 is the interface connection.

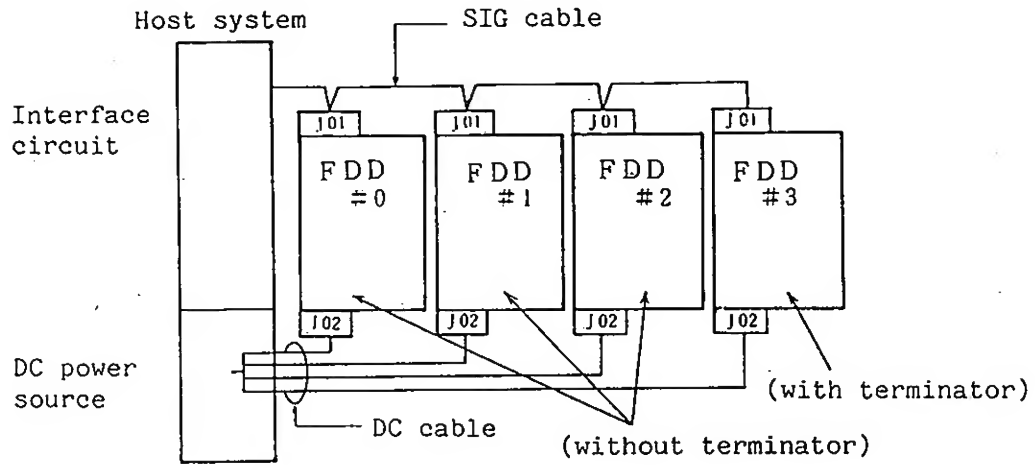


Fig. 6 Daisy Chain Connection

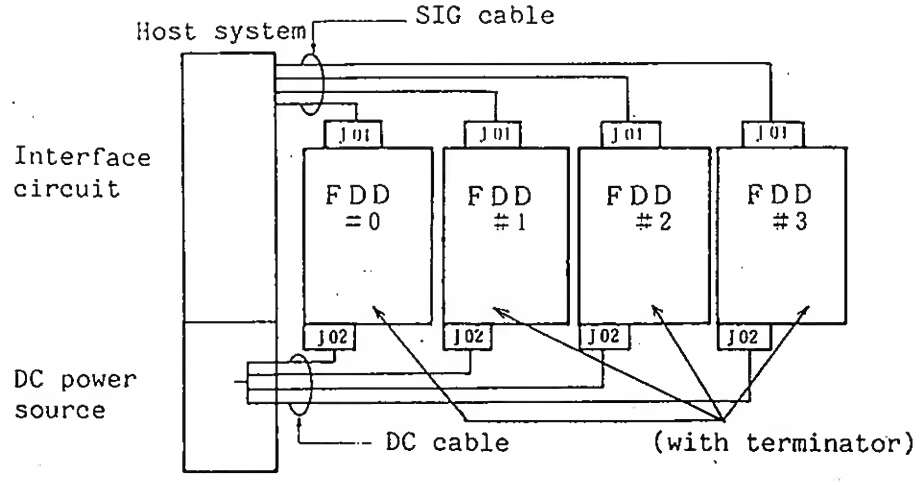


Fig. 7 Radial Chain Connection

Table 6 Cable and Connector

Cable			Cable-side connector		Drive-side connector	
Cable name	Cable type	Cable length	Abbre-via-tion	Specification	Abbre-via-tion	Specifi-cation
SIG cable (for signal)	Flat cable -100Ω AWG #28 or above	3 m (max)	P 01	Producer: 3M "Scothflex" : 3463-0001	J 01	34P card edge
	Twisted pair -100Ω AWG #28 or above			Producer: AMP Housing: 583717-5 Contact: 1-583616-1 Insertion-error preventive key		
DC cable (for power supply)	AWG #20 or above	3 m (max)	P 02	Producer: AMP Housing: 1-480424-0 Contact: 60619-1	J 02	Producer : AMP 350211-1
Ground cable	AWG #20 or above	3 m (max)		Producer: AMP : 61060-1		

Table 7 Dip Switch Selecting Method

Name	Status when shipped	Function	
		When shorted	Precaution
2 of DSW1	DS0 ON	The drive is activated to ENABLE by DRIVE SELECT 0 signal.	Prior to operation, any one of DS0 ∿ DS3 or MX must be shorted. When using plural drive units in daisy chain connection, the same setting must not be applied to two or more drive units; in this case, MX must not be shorted.
3 of DSW1	DS1 OFF	The drive is activated to ENABLE by DRIVE SELECT 1 signal.	
4 of DSW1 —	DS2 OFF	The drive is activated to ENABLE by DRIVE SELECT 2 signal.	
5 of DSW1	DS3 OFF	The drive is activated to ENABLE by DRIVE SELECT 3 signal.	
1 of DSW1	MX OFF	The drive is constantly activated to ENABLE regardless of the DRIVE SELECT signal.	

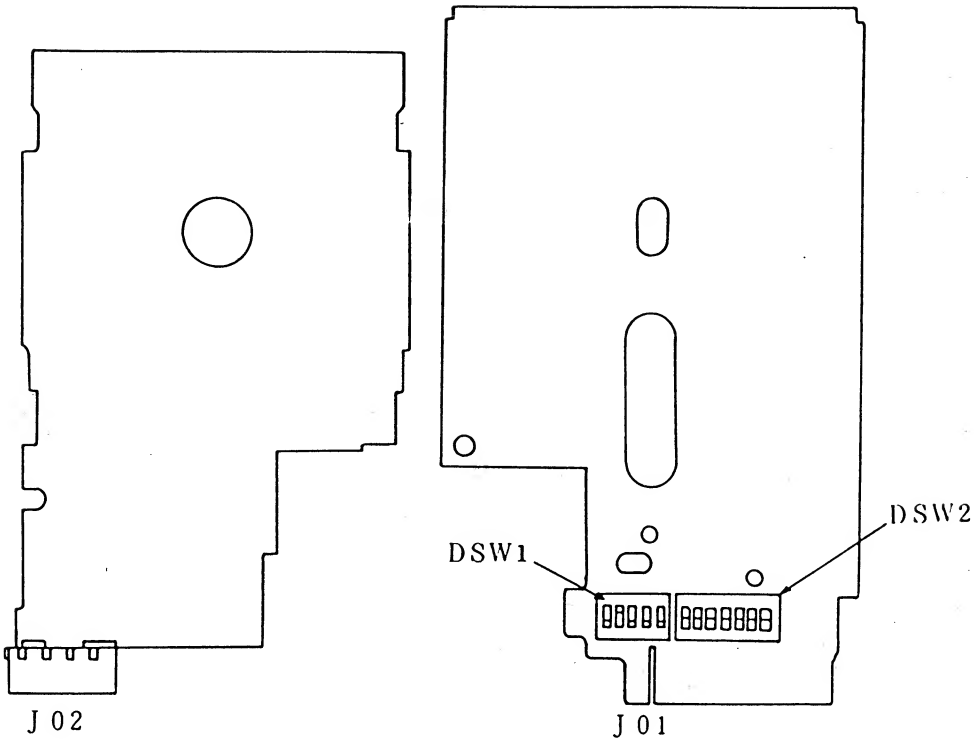


Fig. 8 Connector Mounting Arrangement

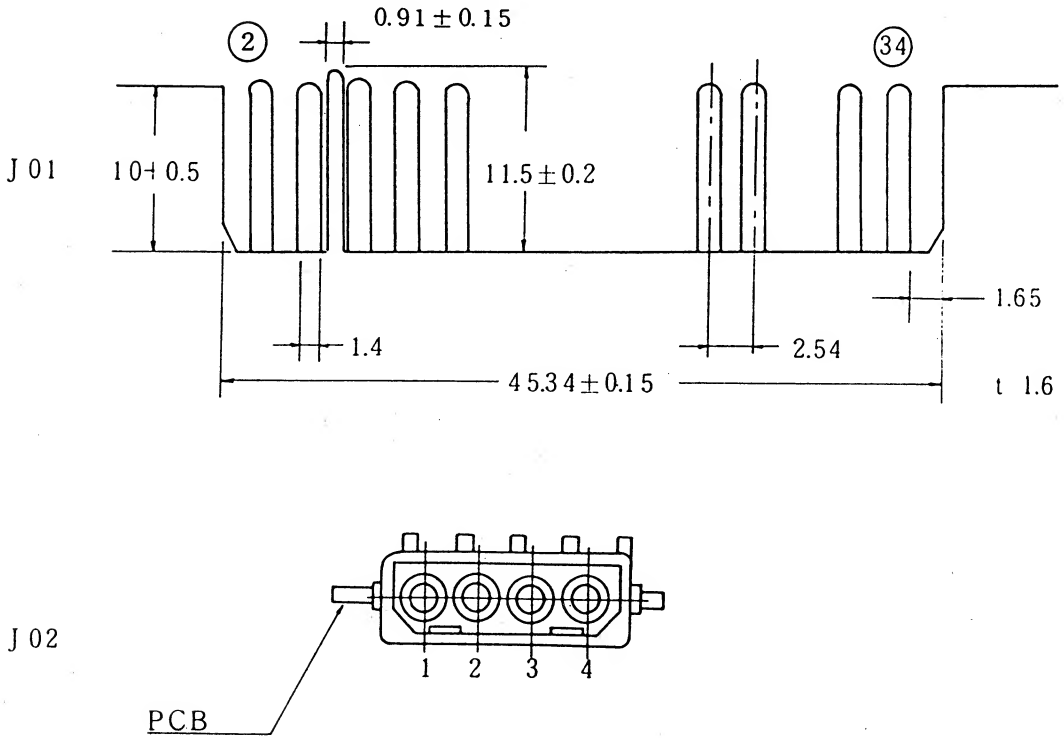


Fig. 9 Connector Pin Arrangement

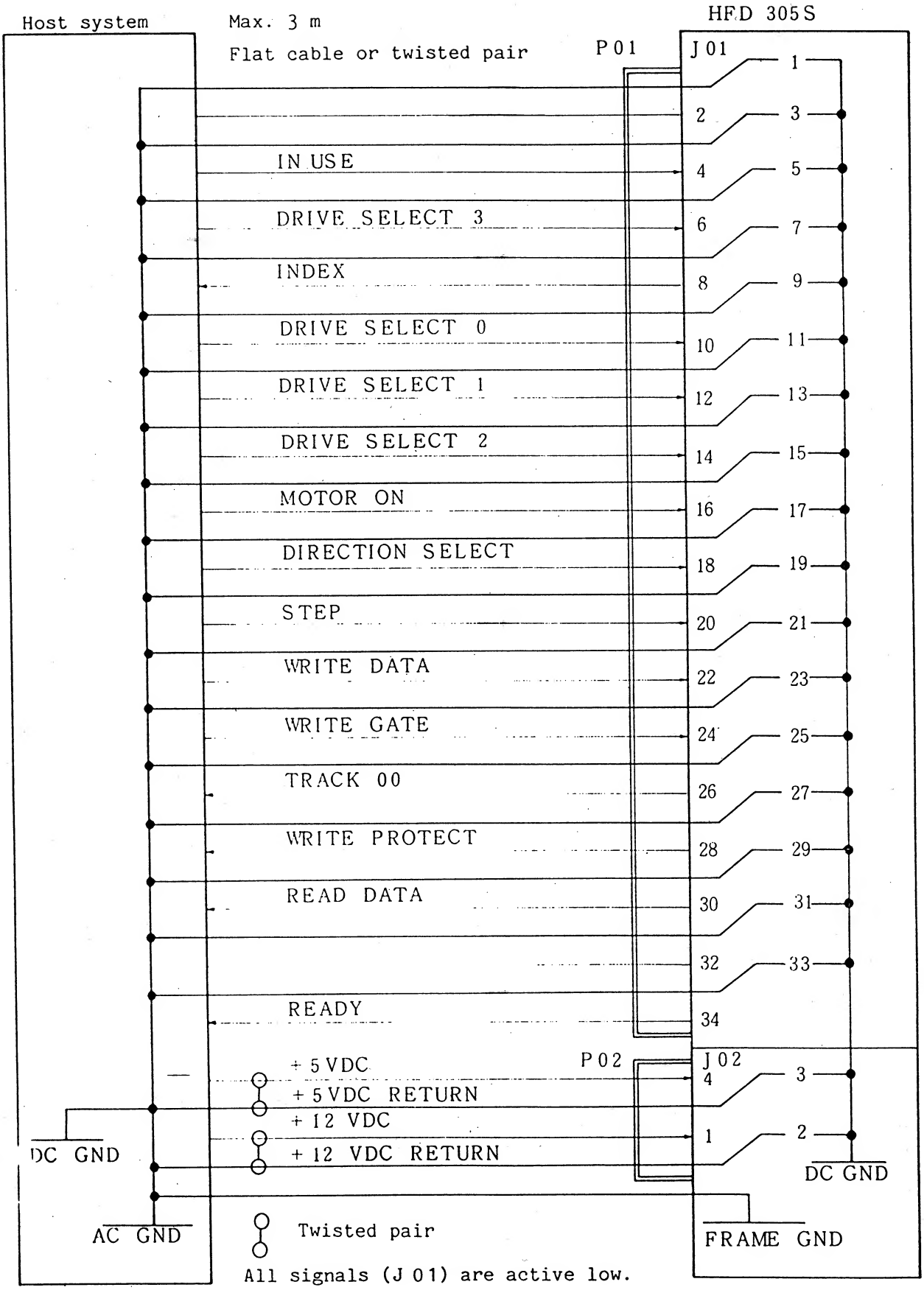


Fig. 10 Interface Connection

When shipped, all DSW2 switches are usually set at the ON status. When using plural drive units in daisy chain connection, set all DSW2 switches to the OFF position except that 2 of DSW2. However, all DSW2 switches of only the drive with the terminator must be set at the ON position. Set DSW1 in accordance with the DRIVE SELECT signal.

(3) Interface Circuit (for signals)

The interface circuit and the input/output signal levels are specified in Fig. 11 and Table 8.

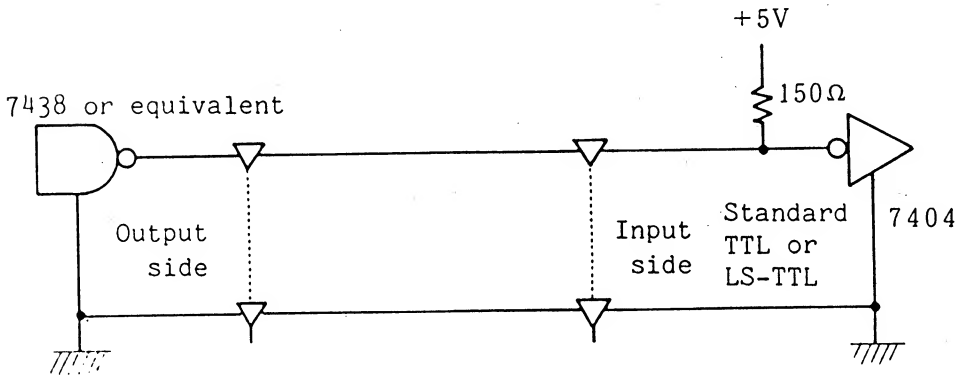


Fig. 11 Interface circuit

Table 8 Input/Output Signal Level

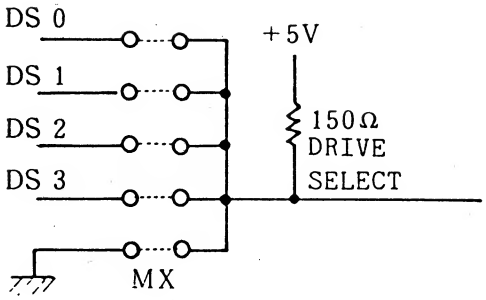
Input signal	High-level voltage	2.4∼ 5.25V (output side: Open collector IOH = 250 μA max.)
	Low-level voltage	0 ∼ 0.4V
	Input impedance	Pull up to 5V with 150Ω.
Output signal	High level	Open collector output IOH = 250 μA max.
	Low level	0 ∼ 0.4V (IOL = 40 mA max)

* Input/output signals are all effective at low level.

(4) Input Signal

(a) DRIVE SELECT 0 ∿ 3

Internal connection of the input lines is connected as shown in the figure on the right.



By turning ON one of the DIP switches, the number of the intended drive is specified.

HFD 305S is shipped with only the DS0 shorted, thus, when the DRIVE SELECT 0 signal is set at the "Low" level, drive selection can be effected for activation of a particular drive. On a system in which plural units of the drive are operated through the daisy chain connection, only one of DS0 ∿ 3 of the drive can be shorted.

(b) MOTOR ON

This input signal, when activated to a "Low" level, will turn ON the drive motor circuit. By turning OFF ("High") this signal during a nonoperating period, motor service life can be extended.

A minimum 0.7 sec. delay after activating this signal (MOTOR ON) is necessary before read/write, so that motor speed becomes stabilized.

(c) DIRECTION

This signal, used to specify the direction of the Read/Write head motion, is defined as follows:

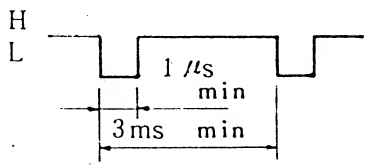
High level: Outward (toward outer side of disk)

Low level : Inward (toward inner side of disk)

Switching the direction must be performed 1 or more μ sec. before the front edge (trailing edge) of a step pulse and 1 or more μ sec. after the back edge (leading edge) of a step pulse.

(d) STEP

This signal causes the Read/Write head to move one step (one track) in the direction specified by a DIRECTION signal. This operation is performed at the front edge (trailing edge) of a step pulse. The minimum period of repetition is 3 ms; repetition at a shorter period will not ensure precise step feed. Exercise care!



(e) WRITE DATA

This is a signal for writing data on the disk. Each transition from a "High" to a "Low" level at the trailing edge will cause current through the Read/Write head to be reversed, thus writing a data bit. This writing is possible only when a WRITE GATE signal is at a "Low" level. Timing accuracy of the WRITE DATA signal must meet the requirements of Fig. 12.

(f) WRITE GATE

When this signal is at a "Low" level, writing data on the disk is possible. This signal must be kept at a "High" level during Read or Seek operation.

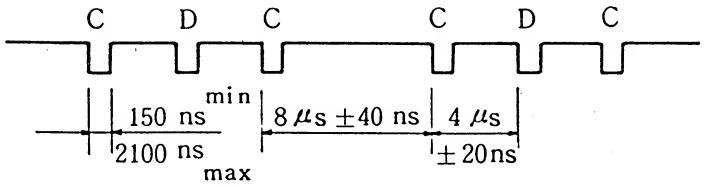
Since the Erase head operates for about 1 m sec. after the WRITE GATE signal has been turned OFF, turning OFF or switching of the DRIVE SELECT signal and the MOTOR ON signal is impossible for a minimum of 1.7 m sec.

Although a STEP pulse is neglected while the Write and Erase heads are in operation, this signal also must be inhibited for a minimum of 1.7 m sec after the WRITE GATE signal has been turned OFF.

(g) IN USE

This signal is used to light the Operation display LED on the front panel. The LED also can be lit by a DRIVE SELECT signal in addition to this signal.

For FM record



For MFM record

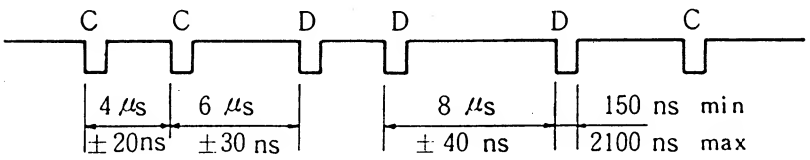


Fig. 12 WRITE DATA Timing Accuracy

(5) Output Signal

(a) INDEX

Upon sensing the index hole once every rotation of the disk, an INDEX pulse is output to indicate the beginning of a track.

(b) TRACK 00

This signal at "Low" level indicates that the Read/Write head is positioned at track 00 (outermost track).

(c) WRITE PROTECT

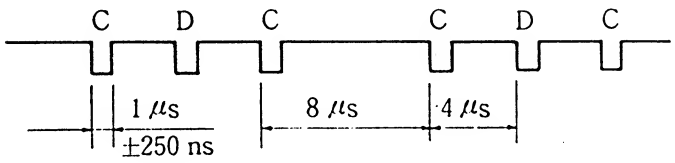
When a write protected disk is installed, this signal is at the "Low" level and the drive inhibits writing.

(d) READ DATA

Normally, "High" level.

When reading data, digitalized data (RAW DATA: clock and data combined) is output.

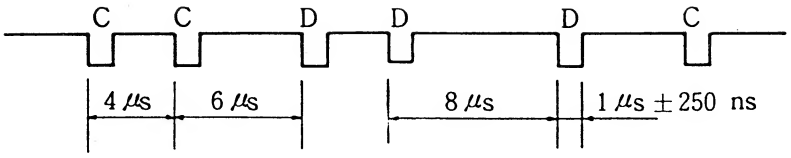
For FM record



C (clock): Leading edge of bit pulse ... ±800 ns max. with respect to the reference position

D (data) : Leading edge of bit pulse ... ±400 ns max. with respect to the reference position

For MFM record



Leading edge of each bit pulse ... ±700 ns max.

with respect to the reference position

(e) READY

This READY signal indicates that the drive is ready for Read/Write operation. The signal becomes "Low" level when all the following conditions are satisfied:

(i) The drive is supplied with +5V and +12V power.

(ii) Drive selecting has been effected.

When the conditions for the READY signal are not satisfied. all other four outputs of items (a) ∿ (d) are turned OFF.

(6) Timing

Figs. 13∼15 illustrate timing of the Interface signal for each operation.

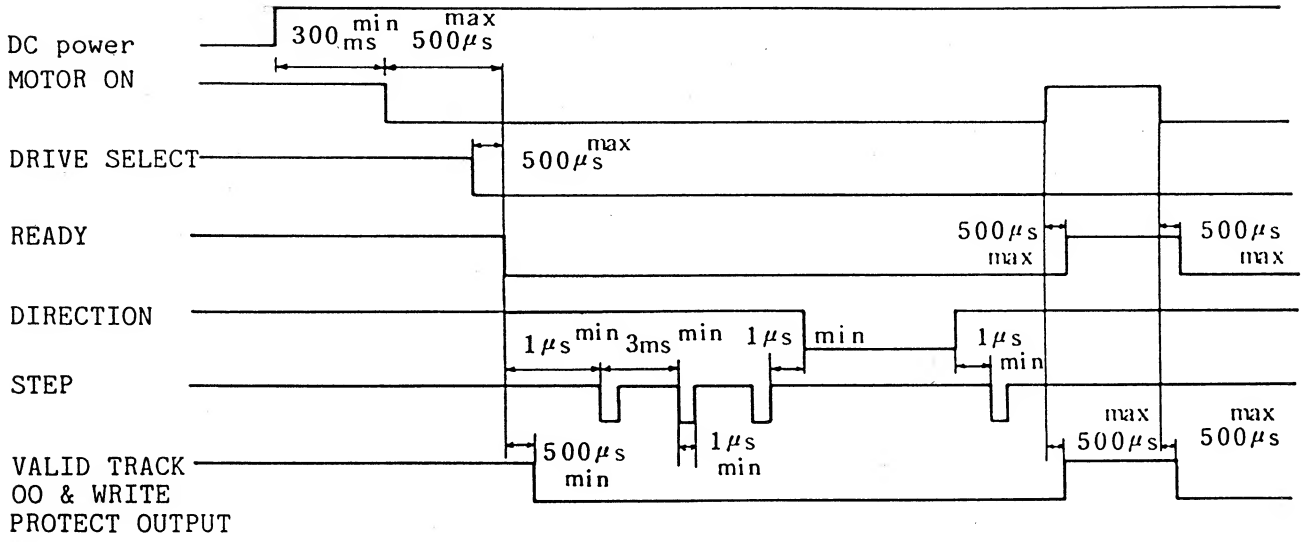


Fig. 13 Track Access Timing

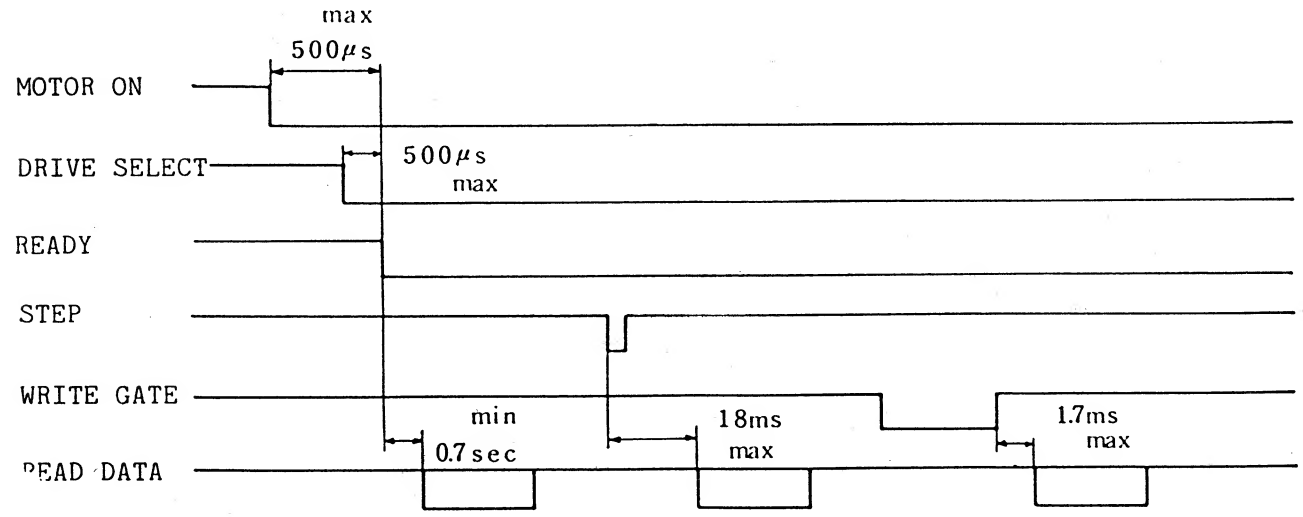


Fig. 14 Read Operation Timing

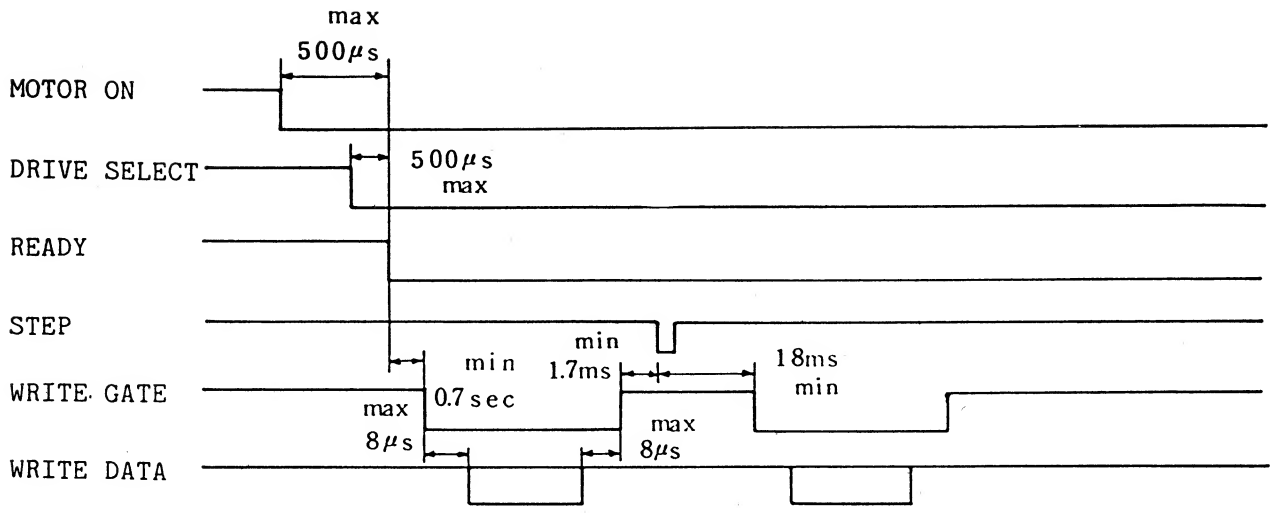


Fig. 15 Write Operation Timing

6. OTHER FUNCTIONS

(1) Head Protect Function

Should an unnecessary step pulse be erroneously input when the head is at the innermost or outermost track, the carriage system may repeatedly suffer mechanical stress. To prevent this trouble, the following logic function operates as a protective measure:

(i) When the TRACK 00 sensor is ON and the track counter reads 0, step feed to the outer circumference is rejected.

(ii) When the track counter (8 bits) has overflown (256 or above), step feed to the inner track is rejected.

Thus, when the power has been turned ON, confirm the READY signal; then, perform step feed to the outer circumference until a TRACK 00 signal is turned ON.